BRIEFING SUMMARY
FLORIDA PHOSPHATE MINING INITIATIVE

REDACTED

Prepared by the
South Site Management Branch
Waste Management Division
U.S. Environmental Protection Agency, Region 4

STATEMENT OF CONFIDENTIALITY AND DISCLAIMER

This document is confidential and is not subject to release pursuant to the Freedom of Information Act. This document is part of an internal deliberative process. It is intended to aid the United States Environmental Protection Agency in the consideration of phosphate mining and related issues in the State of Florida and to aid in the development of a nationally consistent approach to address the industry related issues relative to the statutory provision of CERCLA. It is not intended to provide an Agency endorsement of any one approach, nor does it draw any formal conclusions regarding the issues discussed herein.

EPA PHOSPHATE MINING INITIATIVE OBJECTIVE

The objective of the Region 4 Phosphate Mining Initiative is to ensure the protection of human health, welfare, and the environment at facilities formerly used in the mining of phosphate ore, the refining of phosphate ore, and processing of phosphate ore into phosphoric acid and other related products.

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1.0 INTRODUCTION

As a result of the Government Accounting Office (GAO) review of the United States Environmental Protection Agency's backlog of sites in its Comprehensive Environmental Response, Compensation List and Liability Act Information System (CERCLIS) database, the South Site Management Branch, Waste Management Division, Region 4, discovered it had a significant number of phosphate mining related sites. For the purpose of this briefing, the term "phosphate mining sites" will be used generically, and may include former and currently operating phosphate mines, phosphate ore processing areas, and chemical plants.

A review of the CERCLIS data indicates that there are 21 phosphate mining sites in CERCLIS. A summary of these sites is provided in Appendix A. The majority of these sites were discovered in 1979 and 1980. Preliminary Assessments were completed on the majority of sites by the State of Florida during the early to mid-1980s. EPA conducted Site Inspections on most of the sites in the late 1980s and early 1990s. Site Inspection Prioritizations were conducted by EPA for most of the sites in the mid-1990s. Many of the sites evaluated have preliminary Hazard Ranking System (HRS) Scores higher than the 28.50 threshold for inclusion on the National Priorities List (NPL). Only one site has progressed to the Expanded Site Inspection stage. Results from this study were used to develop a preliminary HRS Score that was well above the threshold.

Rather than proceeding with the proposal of this site to the NPL, the SSMB felt it was important to first consider all of the issues and potential ramifications of attempting to address phosphate mining sites through the standard NPL process. SSMB was concerned that the proposal of this mining site could establish a precedent for how the Region should handle other phosphate mining sites currently in CERCLIS. Hence, SSMB has prepared this briefing summary for the purpose of identifying and summarizing all of the potentially relevant issues that should be considered in formulating a nationally consistent approach for phosphate mining sites.

This briefing summary provides an overview of the phosphate mining industry and attempts to address the following potential issues: regulatory authority; Naturally Occurring Radioactive Materials (NORM) versus Technology Enhanced Naturally Occurring Radioactive Materials (TENORM); Performance Standards; NPL versus NPL-Equivalent Sites; Mega Sites; and potential public and industry concerns. The briefing concludes with a discussion of potential approaches for addressing phosphate mining sites in the Region.

It is important for EPA to develop a well planned approach that balances all of the relevant issues. The decision that is eventually reached for these sites will have significant ramifications. At present, EPA's methodology for the assessment of risk at radiation sites indicates that many of the phosphate mining sites pose an unacceptable level of risk from the exposure of TENORM. However, acceptable radiation exposure limits used by the Nuclear Regulatory Commission (NRC), the International Commission on Radiological Protection

(ICRP), and the National Council on Radiation Protection and Measurements (NCRPM) suggest that the phosphate mining sites would not pose any radiation related human health threats. In contrast, however, use of EPA's risk evaluation protocol suggest the long-term exposures may pose unacceptable levels of risk from long-term exposures to areas contaminated with radioactive wastes.

Finally, in response to the recommendations of Resources for the Future (RFF) in its publication "*Superfund's Future, What Will it Cost?*", EPA is preparing a Superfund Action Plan to address key recommendations. One of the action items is to clarify the role of the NPL and evaluate the appropriateness of the use of the NPL to address sediment and mining related sites. This briefing raises many of the same issues that will likely be considered by OSWER in the development of the Superfund Action Plan, and therefore should be helpful in this study.

2.0 PHOSPHATE MINING INDUSTRY SURVEY

Phosphate is an essential nutrient in the growth of all plants and animals. Though phosphate is a naturally occurring mineral, pressures on the agricultural community to increase productivity using less space, has created an enormous world-wide demand and market for phosphate based fertilizers.

For thousands of years farmers have recognized the need to restimulate exhausted soils to maintain adequate crop productions. Various animal manures had long been one of the favorite choices of farmers. However, many other types of soil amendments have been used, including bone meal, wood ashes, fish, marl, chalk, and ivory clippings. It was not until the mid-1800s that the importance of phosphate for plant growth was discovered. It was eventually discovered that the phosphate is transferred from the soil to the seed which is harvested, thus gradually depleting the phosphate content of the soil.

Mining of phosphate ores in the United States first began in 1867 in South Carolina. For the next 20 years, South Carolina was the main provider of phosphate rock. In 1889, phosphate deposits were discovered in Florida, providing the foundation of the phosphate mining industry known today. The primary source of phosphate rock is derived from the central part of the state from a phosphate deposit known as the Bone Valley Formation. As shown in Figure 1, the formation is located in the west-central part of the State. The estimated areal extent of the formation is 3000 square miles.

The phosphate industry currently represents one of the largest industries in the State of Florida, providing 75% of the nations phosphate supply and 25% of the worlds supply. During the year 2000, 28.6 million tons of phosphate were mined from 5,385 acres of land. Overseas exports were valued at 1.128 billion dollars with China being the largest importer of phosphate fertilizers.

While the phosphate mining industry provides a commodity that is essential to the health and welfare of the citizens of the United States and other countries, it is not without some environmental impacts. In order to obtain the valuable phosphate, it first must be removed from the ground and extracted from the phosphate matrix. Mining of the phosphate is currently done through a strip mining process. Large drag lines with 40+ cubic yard buckets first remove the overlying soil. This overburden is stockpiled for subsequent restoration of the mine. Drag lines then excavate the phosphate matrix. This matrix is then subjected to a high pressure stream of water to form a slurry. This slurry of phosphate rock, sand, clay and water is pumped to processing plants in proximity to the mine. The phosphate ore is further refined through a process known as beneficiation. The beneficiation process is key to maximizing the amount of usable phosphate removed from the ore.

The beneficiation process involves both the physical and chemical separation of the phosphate from the ore. The phosphate ore is generally comprised of one part phosphate, one

Figure 1 - Site Location

part clay, and one part sand. Vast quantities of water are used in this process. By-products from this operation are a water-clay slurry and sand tailings. The clay slurry is typically pumped to a storage area to allow the clay to dry and consolidate. These clay settling areas typically average hundreds of acres in size. Often, multiple clay settling areas are required for the storage of the clay slurry during the life of a mine. Sand tailings are generally pumped back to the strip mine for disposal. Total facility sizes, including the mine, processing areas, and disposal areas typically encompasses thousands of acres and may be in operation for many years.

After the phosphate has been extracted from the ore, it is then processed into many different products. The majority of the phosphate is converted to various grades of fertilizers and feed supplements for agricultural purposes. Some of the phosphate is used in other products such as vitamins, soft drinks, tooth paste, light bulbs, film, bone china, flame-resistant fabric, and optical glass.

Operations of this magnitude correspondingly produce vast quantities of waste by-products. In addition to the clay slurry and sand tailings mentioned above, the processing of the phosphate rock into phosphoric acid creates enormous volumes of calcium sulfate, commonly known as gypsum. Another large waste stream is the waste water effluent from the beneficiation and phosphoric acid production. Although over 90% of the process water is recycled, some discharges occur to nearby surface waters. The primary source of contamination of the clay slurry and sand tailings and gypsum is from elevated levels of $Radium^{226}$ (Ra^{226}) . The Ra^{226} is a radioactive isotope that occurs naturally within the phosphate ore matrix. As the ore is processed, however, the Ra^{226} is released from the ore and accumulates in the waste products. The effluent contains other contaminants, but not typically at significantly elevated levels. The process water, however, does not typically contain elevated levels of radioactive contaminants. The main source of contamination in the process area is from acidic materials that create a pH of approximately 2.

Finally, after the ore is removed from a mine, State law requires that the mine be closed and the land reclaimed. This is a long-term process that addresses the mined areas, clay settling and sand tailing areas, and other areas as appropriate. The process generally includes the preparation of a closure plan that must be approved by the Florida Department of Environmental Protection (FDEP). The planning used generally dictates the nature of the closure. At a minimum, restoration projects typically involve the restoration of wetlands that were impacted by the operations, but often include components for additional uses such as agricultural, recreational, commercial/industrial, and residential. A restoration project can be very complicated and take many years to complete. Pursuant to State law, mining operations completed after July 1, 1975, are subject to mandatory closure. Prior to this date, closures were voluntary, but a State reimbursement program was established to encourage voluntary mine closures. Plate 1 provides the location of mandatory and non-mandatory mines currently regulated by FDEP.

It is the reclamation and future land use phase of the phosphate mining industry that raises the most concern for EPA. As noted in the introduction of this briefing, CERCLA is primarily concerned with the protection of public health, welfare and the environment from potential exposures to contaminants from the phosphate mining process. As the reclamation projects involve plans for a combination of future uses, involving recreation, industrial, and residential purposes, the potential exists for the public's exposure to elevated levels of Ra^{226}.